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DIMENSIONS

NBS



**Lifesavers
for the Home**
See page 6

A PUBLICATION OF THE UNITED STATES DEPARTMENT OF COMMERCE

DIMENSIONS

NBS

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Cover: Lives can be saved if home fires are detected quickly. See page 6 for the story on smoke detectors for the home.

U.S. DEPARTMENT OF COMMERCE

Elliot L. Richardson, Secretary

James A. Baker, III, Under Secretary
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NATIONAL BUREAU OF STANDARDS
Ernest Ambler, Acting Director

Prepared by the NBS Office of
Information Activities
Washington, D.C. 20234
William E. Small, Chief

Richard S. Frazen,
Chief, Editorial Section

Sharon A. Washburn,
Managing Editor

Juli Kelley,
Associate Editor

Staff Contributors, this issue:

Dottie Hafer
Kent Higgins
Madeleine Jacobs
Stanley Lichtenstein
Frederick P. McGehan

Visual Editor
Richard E. White



The National Bureau of Standards serves as a focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. For this purpose, the Bureau is organized as follows:

The Institute for Basic Standards
The Institute for Materials Research
The Institute for Applied Technology
The Institute for Computer Sciences and Technology

Center for Radiation Research
Center for Building Technology
Center for Consumer Product Technology
Center for Fire Research
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Stanley Lichtenstein
NBS public information specialists

WIND RESISTANCE
PROJECT
FOCUSES ON
WORLD PROBLEM

HOUSES VERSUS HIGH WINDS



(Photos by Noel Raufaste)

WINDSTORMS the world over inflict their worst blows on metropolitan and rural communities with low-rise, low-cost and often sub-standard housing and other facilities. From Corpus Christi in Texas to Luzon in the Philippines, from Dacca in Bangladesh to Darwin in Australia, the appalling results are often indistinguishable even though local materials, design, and terrain may differ considerably.

The Agency for International De-

velopment (AID), concerned about the recurring global pattern of storm disasters, is sponsoring a 3-year National Bureau of Standards technical research study of the problem with the cooperation of Philippine building officials and government specialists from countries affected by Caribbean hurricanes, Bay of Bengal cyclones, and Atlantic coastal storms. The Philippines, known for its frequent extreme winds, is serving as the project's "natural laboratory."

Typhoon Aning, in Northern Luzon, razed schoolhouses and other low-rise structures with remarkable ease, leaving these children—like many others—outside looking down at the building's remains. A joint Agency for International Development/ National Bureau of Standards research project is focused on techniques for strengthening structural defenses against such devastation in all parts of the world.

This AID/NBS study as produced a series of progress reports and workshop proceedings* identifying improved structural design practices, better use of materials to strengthen defenses against future extreme winds, and improved community planning.

Drawing in part on data from other countries, the joint project is giving attention to:



• *Design/engineering practices.* For example, roof overhangs and wrongly placed window and door openings contribute to roof failures. The wind pressures under the overhang and interior pressures push the roof upward from the pressures beneath. . . . Simplified procedures for the calculation of wind pressures acting on building surfaces have been developed. These improved procedures provide building professionals with more accurate calculations for better building designs.



Openings can cause dangerous internal pressures.

* NBSIR's 74-567, 74-582, and 75-790 (progress reports), and BSS-56 (workshop proceedings).

• *Use of materials.* Steel, concrete, brick, and plastics compete with other materials traditionally accepted and naturally occurring in various parts of the world—soil, wood, palm leaves, coconut husks, jute, hemp, even peanut shells (as filler material in spaces between roof rafters or structural supports). The AID/NBS researchers are interested in both performance and economic feasibility. Many kinds of material are reviewed, and alternate designs especially consonant with traditional materials, or combining some of these materials with new design features, are suggested.



Nipa palm is semi-aquatic. It does not displace food growing land and can be made into a building material.

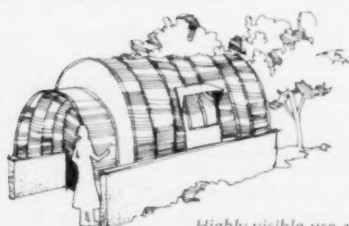


Simple machine makes blocks from soil and cement.



Test house in AID/NBS extreme wind study is shown with pressure transducers in place on roof.

- **Popular acceptance or rejection.** The ease or difficulty of gaining acceptance of proposed new types of construction depends in large part on local culture, tradition, and psychology. Such factors are included as part of the AID/NBS project.



Highly visible use as non-home helps pave way for acceptance.

Prefabricated look-alikes slow down acceptance.



- **Strategic location.** Destructive winds wreak less havoc when communities can be so placed as to take advantage of natural protection.



- **Assessing housing needs.** A method has been developed to allow a country's planners, economists, public officials and other decision-makers to assess housing needs up to 20 years into the future. □

EXTREME WIND STUDY, a 16-minute 16-mm. color motion picture, has been released by the National Bureau of Standards. In contrasting scenes of "killer"-storm destruction, laboratory research, and international conference work sessions, the film depicts an international project that is now nearing completion.

Sponsored by the Agency for International Development with NBS technical support in co-operation with the Philippine Advisory Committee, the project is aimed at the development of improved design criteria and methodology for low-rise buildings to better resist the effects of extreme winds. Noel J. Raufaste, Jr., is project coordinator and Dr. Richard D. Marshall is principal investigator; both are with the NBS Center for Building Technology, Institute for Applied Technology.

EXTREME WIND STUDY is available on free loan from Association Sterling, 600 Grand Avenue, Ridgefield, N.J. 07657. Prints of the film can be purchased for \$73.25 from the National Audiovisual Center, General Services Administration, Washington, D.C. 20409, attention Order Department.

LIFE-SAVING
INVESTMENTS

SMOKE DETECTORS

FOR THE HOME

by Frederick P. McGehan
NBS public information specialist

• In Scotch Plains, N.J., a physician had a \$3,000 fire alarm system installed in his \$120,000 home. The electronically sophisticated system was designed to signal fire and police departments if the temperature at any of 15 points in his house reached 58°C. When a fire occurred at midnight May 14, 1974, the expensive system failed. But a \$59.95 smoke detector did go off—as did four others still in cartons in the basement. The doctor, his wife and 5 children were able to escape. Damage was confined to \$10,000.

• In Mission Viejo, Calif., a mother and her 2 young daughters went to bed as usual the evening of July 26, 1975. At 4 a.m. a neighbor awoke to the sounds of fire next door. He and another neighbor were helpless to rescue the mother and her daughters from the blazing structure. They were found asphyxiated in the hallway and bedrooms of their \$80,000 house. Firemen said later they might have been saved by purchasing a \$40 smoke detector.

THESE two stories illustrate dramatically what countless Americans have been discovering—that the purchase of a relatively inexpensive detector may save their homes—and lives—in the event of a fire. Smoke detector sales reached 50,000 when they came on the market in 1971. Last year sales rose to more than 1 million. And more companies are getting into the lucrative field.

The Commerce Department's National Fire Prevention and Control Administration is spearheading a drive to inform the public of the capabilities and benefits of early-warning fire detection. With increased public awareness has come a demand for authoritative information on the purchase and installation of smoke detectors. A focal point for such information is the Center for Fire Research at the National Bureau of Standards.

Richard G. Bright, a senior research engineer, has been studying smoke and heat detectors at NBS for the past 3 years and is chairman of a committee of the National Fire Protection Association which has issued a standard for the installation, maintenance, and use of household fire warning equipment. Bright has recently been joined by Richard Bukowski, a research engineer who previously

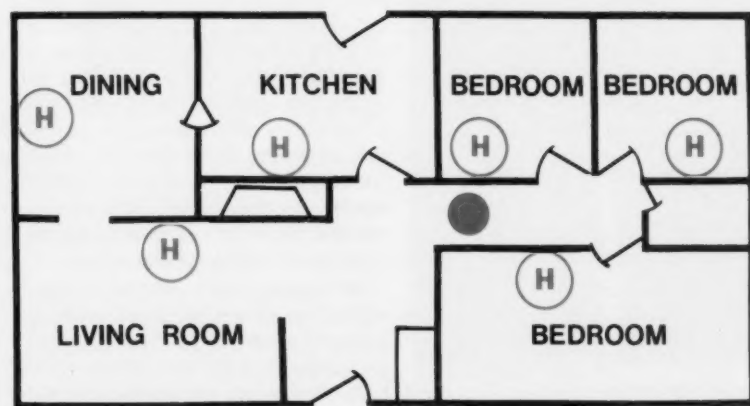
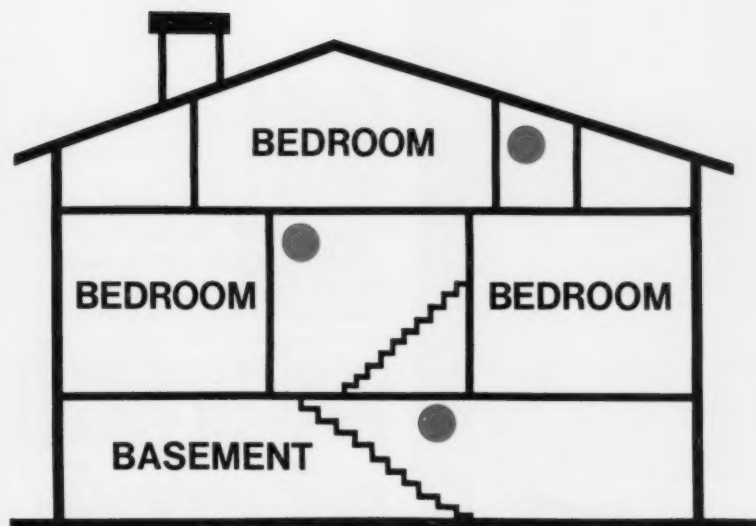
worked on detectors at Underwriters Laboratories, Inc.

Because of the rising interest in home detectors, Bright has been the subject of numerous media interviews and several television appearances. As the result of an interview on the nationally-televised *Today* program in April 1975, Bright received more than 1,000 requests from the public for information on detectors. While not endorsing brand names, Bright supplies respondents with basic information on which to base a purchase decision.

There are two basic types of detectors on the market—heat and smoke. Bright finds that smoke detectors are the best buy. "Heat detectors are too slow. They require a significant buildup of heat before they operate," he says, adding that the temperature at the ceiling has to reach at least 65.5°C. In some cases it is not until close to flashover—when the entire room becomes consumed in flame—that the heat detector signals an alarm.

Heat detectors, Bright finds, are unreliable in detecting a fire other than in the room in which they are installed. Thus to protect a house adequately may require from 5 to 10

turn page



H HEAT DETECTION ● SMOKE DETECTORS

Top. This cutaway view of a two-story house and a basement illustrates the proper location of smoke detectors when there are bedrooms on several levels. A detector on the basement stairway is also recommended.

Bottom. This floor plan of a 6-room, single level house illustrates the difference in protection offered by heat and smoke detectors. To be properly protected by heat detectors it would require the placement of a detector in each room. Only one smoke detector, in the hallway connecting the bedrooms, would be needed.

How Many and Where?

How many detectors you need and where to place them depend in large measure on the type of house or apartment you live in.

If you live in a one-story house with a common corridor joining your bedrooms, one smoke detector mounted on the corridor ceiling or wall near the living area—not the bedrooms—should offer the best protection. If mounted on the wall, the detector should be 15 to 30 centimeters below the ceiling. This is because smoke tends to flow along the ceiling.

If you live in a multi-level house where there are sleeping areas on more than one floor, separate smoke detectors should be placed outside each of these areas. If the bedrooms are clustered around the top of the stairs, then the detector should be installed at the top of the stairs.

In any style house it is important to locate the detector between the bedrooms and other living areas so the detector can intercept smoke before it reaches the bedroom area. The detector should be close enough to the bedrooms so that alarm can be heard in the bedrooms, even with the doors closed.

The National Fire Protection Association recommends that if the living unit has a basement, a smoke detector should be placed along the basement stairway. A U.S. study showed that 11 percent of home fires started in basements.

Smoke continued

heat detectors, at a cost of \$50 to \$70 each.

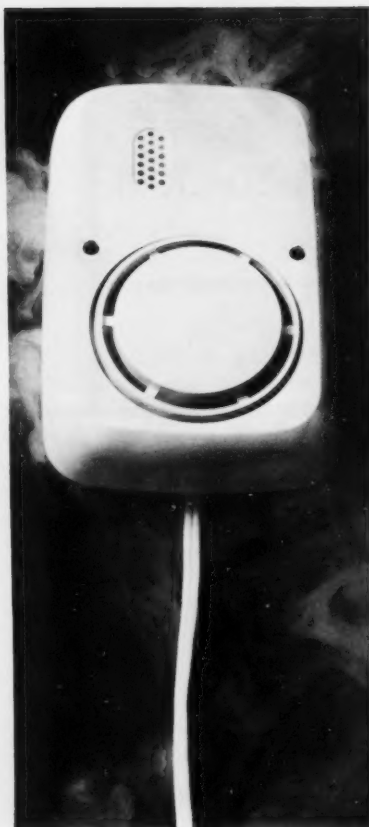
"Smoke detectors by their very nature can monitor smoke far from the point of origin because smoke moves—rising to the ceiling or up stairways," Bright says. As a result, one smoke detector placed on the ceiling or wall of a hallway outside the bedroom areas should provide adequate fire warning in most houses. The sleeping quarters are the most vulnerable because about 60 percent of all fatal household fires occur between 10 p.m. and 6 a.m., when occupants are asleep.

Bright believes that between 40 and 50 percent of the lives lost in home fires could be saved with the installation of one or more smoke detectors. A study of 200 fire deaths in the Washington, D.C. metropolitan area by Francis Brannigan, associate professor of fire science at Montgomery Community College, showed that in 49 percent of the cases people could have saved their lives if they had had smoke detectors in their homes.

There are two basic types of smoke detectors—photoelectric and ionization chamber. Bright finds each has its own advantages and disadvantages.

The photoelectric detector has a chamber containing a photoelectric cell. When a light shines across that chamber under normal conditions the photoelectric cell does not register. However, when smoke is present in the chamber it reflects light back into the photoelectric cell, causing the detector to sound an alarm.

According to Bright, the ionization detector is a bit faster in detecting flaming fires while the photoelectric detector is faster in reacting to smoky fires. If the ionization detector is placed too close to the kitchen area,



(Photo by Mark Helfer)

One smoke detector placed on the ceiling or wall of a hallway outside bedroom areas should provide adequate fire warning in most houses.

it may give an occasional false alarm as the result of smoke generated by cooking.

There are two ways to power smoke detectors—by battery or by 120 volt house current. The battery-operated detector is simpler to install, requiring no connection to an electrical outlet. The battery, however, has a lifetime of about 1 year. These detectors emit a "chirp" sound when the battery is about to wear out, allowing the homeowner to get a replacement.

"We would recommend that taking the time and trouble to put in a 120-volt unit is worth it," Bright says. Most of these detectors come with 270 centimeters of line cord. The alternative is to hire an electrician to install an outlet on the ceiling or high up on the wall. This should add \$25 to \$50 to the cost. A power outage, of course, would knock out this system. There is at least one detector on the market that operates off of house current but also has a non-rechargeable battery as a backup power system.

No matter which detector is purchased, Bright advises that a warning device should not take the place of an escape plan for the family members. Depending on the type of fire and warning system, a family may have between 2 minutes and an hour to get out of a house or apartment before conditions become intolerable. Drills should be held so that family members know what to do in a fire situation, including the possibility of escaping through bedroom windows.

"The best fire detection equipment does no more than tell you a fire is in progress. From this point on what happens is up to you," Bright says. □

by Madeleine Jacobs
NBS public information specialist

CONSUMER
SAFETY, ENERGY
CONSERVATION,
AND PRODUCTIVITY
ARE THE
DRIVING FORCES
AND EXPECTED
BENEFICIARIES
OF THE NEW

NBS Non- destructive Evaluation Program

AN unexpected flat tire due to undetected flaw in the material can cost you time, money, aggravation, and possibly cause an accident. A failure in a reactor due to an undetected flaw in a key component can cause the shutdown of a nuclear power plant and deprive an area of its full power requirements. An unsuspected defect in an aircraft assembly can cause even more disastrous consequences.

Today, many such failures are being prevented thanks to a system of test methods that detects flaws and defects in materials before the failures occur—in fact, before the materials are put into service. Called "Nondestructive Evaluation (NDE)," the system is potentially applicable to inspection of such high-technology products as nuclear reactors and supersonic aircraft as well as to inspection of more consumer-oriented



(Photo by Mark Helfer)

products such as batteries for pacemakers and parts for surgical implants.

Actually, NDE is not a single method, but rather a name used to describe a variety of techniques that can be used to examine materials without destroying or damaging the material during the examination procedure. Some of these methods, such as X-radiography, have been used for many years. Others, such as neutron radiography and acoustic emission, are just now coming into wider use as NDE methods.

Whatever the method, NDE is increasingly popular, especially since materials are becoming more costly and are being used in applications where performance is critical. NDE is a major way to assure quality control during manufacture of goods and to provide trouble-free service if used as an inspection tool over the lifetime of the product or structure.

Improved Standards

Despite the increasing use of NDE methods for practical purposes, there are definite needs to improve the measurement methods and to relate

*Harold Berger places
neutron radiographs for three
dimensional viewing, a
technique that aids inspection
of complex objects.*

measurements to the actual performance of the material. The National Bureau of Standards has established a Nondestructive Evaluation Program to assist industry and other government agencies in this area.

"The overall objective of the program is to improve the reliability of materials and structures through standardized NDE measurement procedures," says research physicist Harold Berger. Berger heads the new program and is one of the pioneers in the development of applications of neutron radiography, an increasingly used NDE method. The program will include technical investigations of standards for NDE methods, both physical calibration standards and procedural documents such as recommended practices, characterization of

turn page

NDE continued

instruments, development of improved techniques, and the assessment of the relation of NDE measurements to materials performance.

The new NBS program is located organizationally in the Institute for Materials Research, Berger explains, but it coordinates related NDE work throughout the Bureau. Nearly two dozen NBS scientists are involved. Also cooperating in the program are industry, technical societies, and government agencies. Cooperating groups include the American Society for Testing and Materials, the American Society for Nondestructive Testing, Argonne National Laboratory, the Electric Power Research Institute, the Nuclear Regulatory Commission, the National Institutes of Health, the Air Force Materials Laboratory, the Army Materials and Mechanics Research Center, the National Aeronautics and Space Administration, and the U.S. Navy.

Major Advantages

Berger explains that NDE techniques offer a major advantage over other methods of inspection. Many such methods today are performed by taking only a random sample of a production lot and literally dismantling the object to see if there are any flaws or defects. In this type of inspection method there is always a possibility that a product not included in the sample might be flawed. With NDE methods, it is possible to inspect every item in a lot if this is desired.

"Nondestructive testing has an obvious impact on improved safety," Berger says. "When faulty components are found by in-service inspection and repaired or replaced

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NDE

Nondestructive evaluation represents a class of industrial inspection techniques used for assigning the integrity of materials or assemblies without impairing their usefulness. NDE tests are designed to reveal the presence of harmful defects such as cracks, porosity, inclusions, and similar inhomogeneities. In addition, NDE methods should detect more subtle inhomogeneities such as those associated with grain size or orientation, internal stress, compositional variations, cold work, and the like, since these variations also may seriously influence the useful life of the component. In each case, the goal of the NDE test must be to identify the inhomogeneity in terms of size and location. In this way, the influence of the defect on materials performance can be reliably assessed.

NDE measurements yield information useful for:

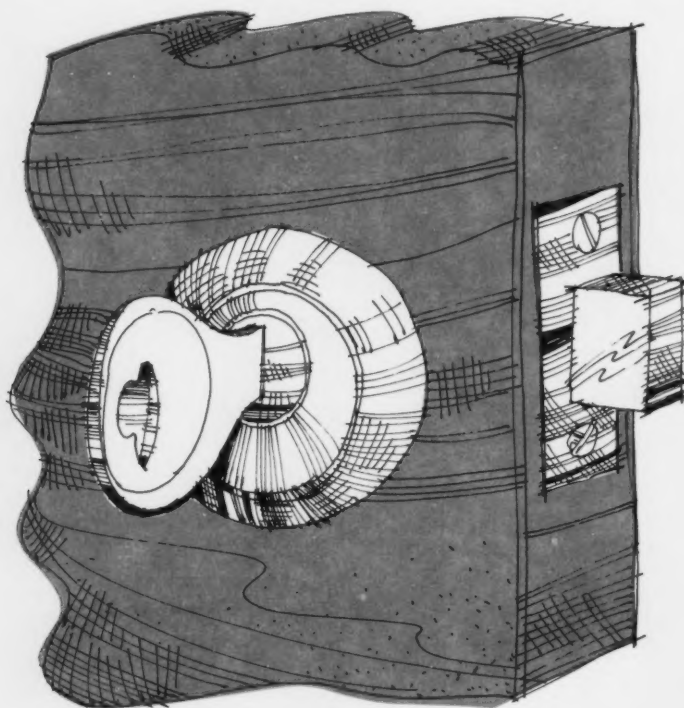
- eliminating defective materials prior to expensive machining or fabrication
- determining the condition of materials or assemblies after a period of use
- monitoring to detect signs of failure during operation
- aiding effective failure analysis to minimize future failure problems.

The NDE methods commonly used in industry tend to be complementary, and it is not unusual to find more than one method used to inspect an object.

Comparison of Common Nondestructive Evaluation Methods

Method	Characteristics Detected	Advantages	Limitations	Sample
Ultrasonics	Changes in acoustic impedance caused by cracks, nonbonds, inclusions, or interfaces.	Can penetrate thick materials; excellent for crack detection; can be automated.	Requires coupling to material either by contact to surface or immersion in a fluid such as water.	Adhesive assemblies for bond integrity.
Radiography	Changes in density from voids, inclusions, material variations; placement of internal parts.	Can be used to inspect wide range of materials and thicknesses; versatile; film provides record of inspection.	Radiation safety requires precautions; expensive; detection of cracks can be difficult.	Pipeline welds for penetration, inclusions, voids.
Visual-Optical	Surface characteristics such as finish, scratches, cracks, or color; strain in transparent materials.	Often convenient; can be automated.	Can be applied only to surfaces, through surface openings, or to transparent material.	Paper for surface finish.
Eddy Currents	Changes in electrical conductivity caused by material variations, cracks, voids, or inclusions.	Readily automated; moderate cost.	Limited to electrically conducting materials; limited penetration depth.	Heat exchange tubes for wall thinning and cracks.
Liquid Penetrant	Surface openings due to cracks, porosity, seams, or folds.	Inexpensive, easy to use, readily portable, sensitive to small surface flaws.	Flaw must be open to surface. Not useful on porous materials.	Turbine blades for surface cracks or porosity.
Magnetic Particles	Leakage magnetic flux caused by surface or near-surface cracks, voids, inclusions, material or geometry changes.	Inexpensive, sensitive both to surface and near-surface flaws.	Limited to ferromagnetic material; surface preparation and post-inspection demagnetization may be required.	Railroad wheels for cracks.

HOME SECURITY STARTS AT YOUR DOOR



Deadbolt lock.

This information resulted from research performed by the Law Enforcement Standards Laboratory, National Bureau of Standards, under the sponsorship of the National Institute for Law

Enforcement and Criminal Justice, U.S. Department of Justice. Pamphlets containing identical material are available free of charge from the Consumer Information Center, Pueblo, Colo. 81009.

If you're worried about the increasing threat to the security of your home and personal belongings, you have good cause. From 1968 to 1973, burglaries increased 31 percent. In 1973, residential losses due to burglary were \$543 million. In the same year, 1,211 out of every 100,000 residences were burglarized.

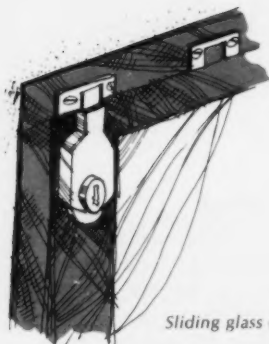
If you want to protect your home against burglary, the place to start is your door. Almost all intruders will try to get through the doors before resorting to the windows. If you have the right kind of doors, locks, frames and hinges, you can increase your chances of keeping burglars out—and your valuables in.

One easy way to make your home more resistant to forced entry is by correcting door construction problems.

General Door Construction Problems

One of the most common ways a burglar breaks through doors is by breaking the strike out of the door frame. The strike is the metal plate attached to the side of the door frame where the bolt latches the door. Frequently, the screws used to attach the strike to the frame are too short, so the strike is easy to break loose from the frame. Screws that are long enough to go all the way through the frame and into the wall studs will make the strike more burglar-resistant. Using a longer than normal strike will also make the door more secure because a bigger strike, secured by long screws, is harder to break out of the frame.

Burglars often break through the glass in and around doors to reach in and open the door from the inside. So, if your house has panes of



Sliding glass door lock.

glass large enough to reach through, and within 1 meter of the door knob or any locking part of the door, you need to take extra precautions. The glass should either be covered with protective grillwork or replaced with a burglar-resistant type of material.

Tempered glass is increasingly being used in place of ordinary glass because it is more resistant to shattering. Laminated glass, acrylic plastic, and polycarbonate plastic are even better choices for vulnerable doors and windows because they are more difficult to break.

Be careful not to install mail slots within reach of the inside door knob or lock. It's easy for burglars to open doors through such openings. You can protect against many "reach-through" break-ins by adding a double cylinder lock. This type of lock can only be opened with a key, whether you're inside or outside the door.

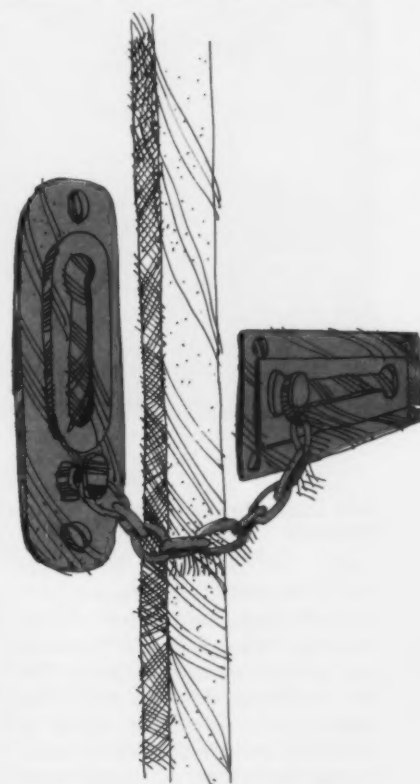
Jalousie doors (doors with glass slats that angle out) also pose problems. It is possible to manipulate the crank or knob that opens the glass

section from outside the door. You can prevent this by removing the knob or lever when it is not in use. As another security measure, you can drill a small hole through both the housing and the shaft of the knob or lever. Then you can insert a pin through the hole to prevent the crank from being turned.

Sliding glass patio doors are particularly vulnerable break-in points. The doors can often be removed by lifting them from the grooves they slide in—even from the outside. Spacers or protruding screw heads can be installed in the grooves over the door to prevent this type of removal. Many patio doors have rather weak latches, which can easily be broken by prying the door away from the frame. Placing a piece of pipe or a broom handle in the bottom grooves can prevent the door from being opened if the latch is broken. You may also want to add a stronger than normal lock to these doors. There are special sliding door locks that are both strong enough and of such a design as to prevent removal of the door.

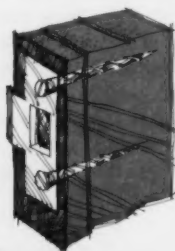
The manner in which conventional wooden door frames (often called the door jambs) are attached to the wall can also pose a security problem. Frequently, there is a space between the door frame and the wall studs (the part of the wall to which the frame is attached) that allows the frame to be spread so as to disengage the lock. This problem can be corrected by putting wood spacers between the frame and studs where the strike plate and the hinges are attached. If you have a metal door frame installed in a masonry wall, you should be sure that the space

continued on page 22



Chain lock

Strike plate with long screws.



HIGHLIGHTS



(Photo by Mark Helfer)

Sounds of Silence

Members of the Juilliard String Quartet on March 31 tested old and new instruments in the anechoic chamber at NBS. In this unique chamber, more than 99 percent of the sound above 50 Hertz is absorbed. Since sound reflection off the walls is eliminated, the chamber has a feeling of "free space." While NBS scientists made measurements, Quartet members tested the true acoustical properties of their own rare 17th and 18th century instruments with those of a matched set of new instruments made by Massachusetts instrument-maker Marten Cornelissen. Normally, the anechoic chamber is used by NBS scientists to calibrate microphones, community noise analyzers, hearing aids, police sirens, and other objects that make or measure noise.

Data Center for Coal Conversion Materials

NBS, in cooperation with the Energy Research and Development Administration, has started a data center for failure analysis of materials used in coal conversion systems. The data center collects, evaluates, and disseminates information related to the failure analysis of materials used in coal gasification and coal liquefaction plants and equipment. The purpose is to provide operating and design personnel with information and service-life characteristics of materials exposed to various hostile environments. The data are made available through the ERDA Materials and Components Newsletter, reports to ERDA Program Managers, direct re-

ports to operating and design engineers, publications, and presentations at technical meetings.

Mandatory Energy Labeling

An energy labeling program for consumer products has become mandatory under the Energy Policy and Conservation Act. NBS is required to develop test procedures for estimating the annual operating costs of appliances and equipment and to provide at least one other useful measure of energy consumption to assist consumers in making purchasing decisions. The Federal Energy Administration has responsibility for administering the Act. The Federal Trade Commission has regulatory authority. Appliances and equipment

covered by the Act are refrigerators and refrigerator-freezers; freezers; dishwashers; clothes dryers; water heaters; room air conditioners; home heating equipment, not including furnaces; television sets; kitchen ranges and ovens; clothes washers; humidifiers and dehumidifiers; central air conditioners; furnaces; other consumer products as required.

Computer Workshop

NBS, the Electronic Industries Association, the Association for Computing Machinery (SIGGRAPH), and the Institute of Electrical and Electronic Engineers (Computer Society Technical Committee on Machine Pattern Analysis) will cosponsor a Workshop on Standards for Automatic

Image Pattern Recognition to be held June 3 and 4 at NBS. The Workshop will consider the issues related to the development of data bases in a standard format on magnetic tape. Such benchmark images would allow inter-comparison of various approaches to automatic pattern recognition. The issues of subject matter, tape format, and documentation will be highlighted. For further information, contact Dr. John Evans, NBS, A130 Technology Bldg. Washington, D.C. 20234. Phone (301) 921-2381.

Magnetic Disk Calibration

NBS has extended its low and medium density magnetic disk calibration services to include the new high density data surfaces. Submitted disks will be calibrated with respect to the NBS primary standard reference data surface on two tracks at two frequencies. For further information, contact the Data Acquisition and Storage Section, NBS, B212 Technology Bldg., Washington, D.C. 20234. Phone (301) 921-3723.

Frequency Symposium

The second Symposium on Frequency Standards and Metrology sponsored by NBS and the International Union of Radio Science will be held July 5-7, 1976, at Copper Mountain, Colo. Frequency standards throughout the electromagnetic spectrum will be covered, such as microwave beams, storage devices, stabilized lasers, infrared and optical beams, 2-photon techniques, aspects of time and length standards, infrared and visible frequency synthesis, measurement principles and limitations, and the relation of this field to specific scientific disciplines such as relativity. For further information,

contact Helmut Hellwig of the Time and Frequency Division, NBS, Boulder, Colo. 80302. Phone (303) 499-3277.

Solar Heating Equipment Standards

NBS is developing Intermediate Minimum Property Standards that the Department of Housing and Urban Development's Federal Housing Administration can use to determine the acceptability of solar heating equipment for mortgage insurance. As feasible, the standards will establish requirements and evaluation procedures for residential solar hot water and space heating systems which are comparable to those presently used for conventional (gas, oil and electric) systems. Completion of the standards is scheduled for May 1976.



(Photo by Mark Helfer)

Protection for Fire Fighters

A National Protection Association standard for fire fighters' turnout coats, based on NBS work, has been accepted by the American National Standards Institute. NBS has been in-

terested in turnout coats since tests in 1971 showed that such apparel sometimes provided less fire protection than did clothing which complied with an NBS-developed standard for small children's sleepwear.

New Tungsten SRM's

Two new tungsten Standard Reference Materials have been issued by NBS. SRM 730 is for thermal conductivity; the other, SRM 799, is for electrical resistivity. Both have been certified as a function of temperature from 4 K to 3000 K. These SRM's will be useful for intercomparing thermal conductivity and electrical resistivity apparatus, debugging new apparatus, and calibrating comparative apparatus. They are available either as sintered or arc cast rods in a variety of sizes. Information on prices and sizes can be obtained from the NBS Office of Standard Reference Materials, B311 Chemistry Building, Washington, D.C. 20234. Telephone: (301) 921-2045.

Standard for School Paste

Printed copies of Voluntary Product Standard PS 64-75, "School Paste," are now available. The standard was processed by NBS under the Voluntary Product Standards procedures of the Department of Commerce. The purpose of the standard is to establish nationally recognized requirements for performance, quality, safety, and packaging and to provide a basis for common understanding among producers, distributors, and users of school paste. Order prepaid for 35 cents by SD Catalog No. C13.20/2:64-75 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20234. □

Metric Activity Continues to Accelerate in Nation's School Systems

A survey of State education departments by the National Bureau of Standards finds notable gains in metric education during 1975. Departments in all 50 States reported some level of metric activity.

The number of State school boards that have adopted formal "go metric" resolutions rose from 14 in 1974 to 26 in 1975, an 86 percent increase. These resolutions generally call for a phasing-in of metric education and often set target dates by which time all pertinent textbooks will utilize only metric measurements.

Twenty-six States reported holding workshops to acquaint teachers with the metric system (18 states reported such workshops in 1974), 16 States have produced educational television films or other visual materials on metric (versus eight States that reported such activity in 1974), and 14 States have formed metric committees to assist in the conversion process (a gain of two over 1974).

Jeffrey V. Odom, chief of NBS' Metric Information Office, noted that the signing of the Metric Conversion Act of 1975 by President Ford on December 23 will add further stimulus to the "go metric" movement. The Act sets as national policy the coordination and planning of increased metric use and establishes a 17-member U.S. Metric Board. A representative of the educational community will sit on that Board.

Some examples of State metric activity:

In Connecticut, the State Board of Education adopted a resolution recommending local and regional school districts begin metric instruction no later than September, 1977. More than 50 workshops were held to acquaint 1,500 teachers and adminis-

trators with the metric system. The Education Department also plans educational television programs on metric.

In Delaware, a "Think Metric Week" was held October 12-18, 1975, for students in kindergarten through high school. A "Think Metric" news letter was distributed to all schools and a metric conference is planned for business, industry, education, and the consumer May 3-4, 1976.

In Illinois, the State Board of Education, on April 24, 1975, adopted a metric policy statement that provides metric as the "official instructional system of measurement" by 1980 in all public schools in the State. Subsequently the Illinois Office of Education developed guidelines and an implementation plan for the change-over.



In Louisiana, the State Legislature approved a Resolution encouraging the State Department of Education to institute metric education programs within the State school system. Subsequently, the State Board of Education approved a plan to implement this resolution. A pilot program in metric education, funded by \$50,000 from the State Department of Education, has begun in one parish (county).

In Kentucky, the State Department of Education adopted a resolution on September 10, 1975, requiring schools to begin providing instruction in metric measurement during the current school year and give "major emphasis" to metric by the 1980-81 school year.

In Michigan, the State School Commissioner has made metric education a Bicentennial Horizons Goal for the State Department of Education during 1976. A complete set of guidelines for metric education will be distributed throughout Michigan schools as part of this project.

In New York State the Commissioner of Education issued a policy statement on January 17, 1975, that encouraged the development of pilot school districts to produce metric education programs that could be applied statewide. More than 60 workshops on metric were given for teachers in New York during the 1974-75 school year.

For additional information about metric education, contact the Metric Information Office, NBS, Washington, D.C. 20234, (301/921-2658). This office has established a national speakers bureau and welcomes inquiries from interested groups and organizations. □

Successes in Teaching Metric Described in Publication

A new publication from the Commerce Department's National Bureau of Standards describing "Successful Experiences in Teaching Metric" will be a valuable resource for teachers planning a metric curriculum.

The 106-page NBS Special Publication 441 contains papers presented at a well-attended conference on metric education held at NBS May 20-21, 1975. It offers the experience of 17 teachers and administrators who successfully introduced metric into their classrooms and school systems. It also includes presentations by Senator Claiborne Pell of Rhode Island and Dr. Richard W. Roberts, former director of NBS and currently Assistant Administrator of the Energy

Research and Development Administration.

Covered in the publication are papers dealing with metric and elementary education, science and mathematics education, school libraries, home economics, sports and physical education, and audio visual aids. Other papers in the publication deal with preservice teachers training, metric education workshops, principles and practices of teaching metric, administrative aspects of metric education at State and local levels, teaching metric for the blind, and benefits gained from English and Australian experiences in metric conversion programs.

Interest in metric was heightened December 23 when President Ford

signed into law the Metric Conversion Act of 1975. The law provides for creation of a 17-member U.S. Metric Board to coordinate voluntary conversion to the metric system.

Copies of NBS Special Publication 441 may be ordered prepaid for \$2.30 by SD Catalog No. C13.10:441 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Foreign remittances must be in U.S. exchange and include an additional 25 percent of the publication price to cover costs. Order microfiche copies prepaid by NBS designation from the National Technical Information Center, Springfield, Va. 22151; the price is \$2.25 (domestic) or \$2.95 (foreign) a copy. □

Supplement to Energy Saving Handbook, EPIC, Available

A supplement to the popular Energy Conservation Program Guide for Industry and Commerce (EPIC) is now available to help large and small businesses achieve significant energy savings.

Prepared by the National Bureau of Standards and the Federal Energy Administration, the 89-page EPIC supplement contains revisions to the original publication and additional ideas and suggestions to establish or improve successful energy conservation programs in industry, commercial firms, hospitals, universities, research

institutes, public utilities, and other energy-using organizations.

The supplement and the original EPIC guide, published in September 1974, are intended to be used together. Both can be purchased from the Government Printing Office. Individual copies of EPIC and the supplement cost \$2.90 and \$2.25 respectively, with quantity discounts available.

The EPIC supplement contains a reorganized and simplified explanation of how to implement an energy conservation program. It also expands

the checklists of Energy Conservation Opportunities (ECO's) found in EPIC. ECO's, a key part of the guide, are one-sentence tips suggesting specific ways to conserve energy in 13 functional and operating areas, such as commercial practices, electric power, process changes and materials handling.

More than 200 ECO's are suggested in the 212-page EPIC handbook. These checklists are referenced and supported by actual case histories illustrating how energy savings have already been achieved in many organizations. Illustrations are based on industrial and commercial experiences. In addition to a brief description of the action taken to achieve energy savings, the case histories include graphs, tables, and sample calculations from which a company

turn page

NBS Issues Aids for COBOL Program Conversion

EPIC *continued*

can estimate its potential for saving energy and reducing costs.

The supplement contains 2 dozen additional case studies. For example, from the supplement a company could learn precisely how one manufacturing plant saved \$14,000 a year by installing a waste heat recovery system in two steam boilers.

Other section of EPIC provide supporting information for a conservation program. Sections are devoted to data and conversion factors pertinent to energy conservation, financial analysis procedures for evaluating projects, sources and organizations to contact for information on energy conservation, possible safety, health, and pollution considerations that may impact on conservation measures, techniques for developing employee participation in an energy conservation program, a brief guide to the existing technology and instruments for measuring energy-related flows, and a bibliography of energy conservation articles.

The supplement adds information to some of these sections, such as the regulations of the Occupational Safety and Health Administration.

EPIC and the EPIC supplement are available as pre-punched three ring books that are intended to be collated in a three ring binder. EPIC can be ordered at \$2.90 a copy (25 percent discount on orders of 100 or more) by sending check, money order or Superintendent of Documents coupons to Government Printing Office, Washington, D.C. 20402. Please use SD Catalog No. C13.11:115 when ordering copies of EPIC. The EPIC supplement can be ordered at \$2.25 a copy (25 percent discount on orders of 100 or more), SD. Catalog No. C13.11:115/1. □

THE National Bureau of Standards has issued aids to assist in the design and conversion of programs that are to be compiled in accordance with the revised 1974 COBOL standard (FIPS PUB 21-1), the Federal adoption of American National Standard COBOL (X3.23-1974).

The NBS publication, designated Federal Information Processing Standard Publication (FIPS PUB) 43, contains a detailed listing of COBOL language additions, deletions, and changes and a side-by-side comparison of language elements in the earlier version of the standard (FIPS 21-X3.23-1968) and the 1974 standard COBOL.

COBOL (the Common Business-Oriented Language) is the major computer programming language used by government agencies. COBOL, currently the only Federal standard computer language, is maintained

through voluntary user and industry standardization efforts.

The aids were developed by an interagency task group on COBOL (FIPS Task Group 9) as a means of informing COBOL users of the differences between the two versions of the COBOL standard and as a handy reference in converting existing COBOL programs for use with compilers conforming to the revised specifications.

FIPS PUB 43, entitled "Aids for COBOL Program Conversion (FIPS PUB 21 to FIPS PUB 21-1)" is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog No. C13.52:43) at a cost of \$1.10. Microfiche copies are available from the National Technical Information Service, 5825 Port Royal Road, Springfield, Va. 22151 (refer to NBS-FIPS-PUB-43 and title). □

Key to Data on Cryogenic Fluid Mixtures Published

THE National Bureau of Standards Cryogenic Division has prepared a comprehensive guide to the experimental phase equilibria and thermodynamic properties data on binary and multi-component mixtures of the molecular species most often encountered in low-temperature applications.

Published under the title, "Equilib-

rium Properties of Fluid Mixtures—A Bibliography of Data on Fluids of Cryogenic Interest," the guide aims to provide complete references to all experimental data available up to 1975 on fluid mixtures of cryogenic interest. It thus assembles for research workers and engineers references to the data essential to accurate design of all low-temperature separation,

New Research Associate Program for Metal SRM's

purification and liquefaction systems impacting the LNG (liquefied natural gas), petroleum processing, and air separation industries.

Data are categorized in ten independent sections and cover combinations of 26 molecular species: solid-liquid, solid-vapor, solid-liquid-vapor, liquid-liquid, liquid-vapor, and gas-gas systems; liquid mixtures and gas or vapor mixture densities; Joule-Thomson coefficients; and calorimetric measurements.

Each section contains a chart showing at a glance the availability of data for each binary system, a bibliography, a table describing the type and extent of data available for each binary system, and a similar table for ternary and higher systems.

Selected physical properties of the molecular species considered have also been conveniently listed, namely: molecular weight, triple point, normal boiling point, critical temperature, and critical pressure.

Authored by Michael J. Hiza, Arthur J. Kidnay, and Reid C. Miller, the bibliographic guide is a 160-page, hard-cover, large-format volume in the NSRDS (National Standard Reference Data System) Bibliographic Series of the NBS Office of Standard Reference Data. Copies are available at \$29.50 each from IFI/Plenum Press, 227 West 33rd Street, New York, N.Y. 10011. □

THE National Bureau of Standards and the American Society for Testing and Materials (ASTM) have established a new Research Associate Program at NBS in the area of Standard Reference Materials.

Under the new program, ASTM is sponsoring a research associate to work at the NBS facilities in Gaithersburg, Md., in the Standard Reference Materials (SRM) program. The objective of the NBS/ASTM venture is to maintain the availability of current metals-related SRM's and to develop new SRM's for use in laboratories of metals and related materials industries.

NBS SRM's are materials whose chemical composition or particular chemical or physical properties have been accurately determined and certified. About 1000 SRM's are currently available from NBS and are used throughout industry and the scientific community to calibrate and evaluate measurement instruments and test methods.

Recently, in response to new national concerns, NBS has become deeply involved in the development of SRM's for use in environmental and

clinical chemistry applications. Its resources being essentially constant, NBS has had to look for alternative mechanisms in support of its more traditional tasks, e.g., the continued production of metal SRM's used in that industry to control the quality of its output. Thus, ASTM Committees E-2 on Emission Spectroscopy, E-3 on Chemical Analysis Metals, and E-16 on Sampling and Analysis of Metal Bearing Ores and Related Materials formed a coordinating committee to explore how industry, acting through ASTM, could interact strongly with NBS to insure a continued and increased supply of these SRM's.

This committee recommended that an ASTM research associate be appointed to work at NBS to determine
turn page

New Research Associate at NBS—Newly appointed NBS/ASTM Research Associate James I. Schultz (right), NBS Standards Coordinator Robert E. Michaelis, and research chemist Ryna Marineko examine electron probe microanalysis of a metal that is being considered as an NBS Standard Reference Material (SRM). The electron probe microanalyzer is one of many sophisticated methods used in certifying materials as SRM's.



(Photo by Mark Helfer)

Metal SRM's continued

what SRM's are needed and to help NBS coordinate their development.

To fill this position ASTM selected James I. Schultz, a former NBS chemist. Prior to his retirement from NBS, where he worked for more than 25 years, Schultz held the dual role of SRM coordinator for the Analytical Chemistry Division and assistant section chief for the Analytical Coordination Chemistry Section. Schultz has been a member of ASTM and its technical committee on chemical analysis of metals for 17 years.

Research associates are trained scientists and technicians sponsored by industrial companies and trade and professional organizations to work at NBS on special projects of interest to both the sponsor and NBS. The sponsoring organization, with the advice and consent of NBS, selects its own research associates who remain the employees of the sponsor.

At the beginning of this year, there were 19 programs at NBS involving 62 research associates. Organizations and individuals interested in more information on the NBS Research Associate Program, should contact P. R. de Bruyn, Industrial Liaison Officer, NBS, Administration Building Room A402, Washington, D.C. 20234, 301/921-3591. □

NDE continued

before a major failure occurs, everyone is safer and economic losses are less severe."

He also points out that NDE reduces the use of materials and energy by minimizing the waste involved in producing defective material, eliminating the need for overdesign of products, and permitting the substitution of available materials for less available.

"Of course, the economic benefit of NDE in the form of increased productivity is a major impetus for increasing application of the NDE technology," Berger adds. "When defective material is discovered early in the manufacturing process rather than after costly fabrication is completed, the time, energy, and material that would have been used in the additional fabrication are saved. When NDE data are used to improve the production process upstream, and thereby minimize the introduction of defective material, even greater economic benefits are reaped."

Six Common Methods

The NDE program will concentrate on the needs for improved measurement and calibration standards and procedures for the six common methods used in industry and under study at NBS—visual-optical, magnetic particle, ultrasonic, penetrant, radiographic (both X-ray and neutron), and eddy current (see box). "Currently, there is significant variability in our nondestructive measurements—variability in terms of consistent, quantitative, and meaningful data," Berger says. "The purpose of the program is to help bring these methods to a point where measurements can be made in a more mean-

ingful and reliable manner. Ultimately it is hoped that reproducibility of measurements will be improved and calibrations will have traceability to NBS."

A more difficult task, Berger admits, will be trying to relate material behavior to actual NDE measurements so that the performance of materials under both new and in-service conditions may be reliably predicted. To do this the NDE technology must be capable of quantitative and reliable flaw detection. In addition, the NDE measurement of material properties, such as hardness or residual stress, will also have to be accomplished.

Such a program, is already under way at NBS in at least one field, acoustic emission. This program, partially funded by the Electric Power Research Institute, is aimed at developing a theoretical basis for acoustic emission spectral analysis to characterize moving cracks or defects. The program includes work for improved transducer calibration. In this program the theory to predict the acoustic emission spectral characteristics expected to be emitted by a moving defect, such as a crack being propagated in a material, will be developed and verified by experimental work in both transparent materials and metals.

The development of advanced materials and energy technologies is demanding greater performance from materials, Berger says, and there is an increasing need to qualify materials on the basis of their performance, not only as they are produced, but also throughout their lifetimes. The NBS program in Nondestructive Evaluation is aimed at helping NDE methods meet this challenge. □



(Photo by Mark Helfer)

NDT Symposium Set For May

NBS will host a Symposium on Nondestructive Testing Standards in Gaithersburg, Md., May 19-21, 1976. The meeting will examine present nondestructive testing standards, point out where they are unsatisfactory, and suggest directions for improvement. The meeting will be cosponsored by the American Society for Testing and Materials and the American Society for Nondestructive Testing. The American National Standards Institute is also cooperating in the meeting.

NBS technician uses scanning microdensitometer to obtain data from radiographs.

Security continued

between the jamb and the wall is filled with mortar.

Locks

Choosing the right lock is a very important security consideration. If your primary lock is the key-in-knob type, it is easily attacked and should be replaced with a stronger lock, or an additional lock should be installed.

If the latch bolt on your lock does not have a spring plunger that will automatically lock the latch when it goes into the strike, your door is vulnerable. It can be a simple matter to stick a thin piece of metal or a credit card between the door and the frame and open the latch bolt. In many cases, a latch bolt that does not have an automatic locking mechanism can be replaced by one that does, at a low cost.

The security of your door can also be increased by adding a good dead-bolt lock. A deadbolt is a straight bar, usually rectangular, that is squared off at the end and locked only by turning a key or knob. The deadbolt of a lock, or any slide bolt used to back up a primary lock, should be at least 1.6 cm ($\frac{5}{8}$ inch) square, made of steel or solid brass, and, preferably, stick out of the lock more than 1.3 cm ($\frac{1}{2}$ inch). A vertical-bolt type of deadbolt is particularly effective in resisting a burglar who tries to break in by forcing the door from the frame and is considered to be one of the most secure locks available, especially for double doors.

A well-known and often-used lock is the chain lock. It allows you to open the door a few inches and see visitors without undoing the chain. DO NOT use chain locks as your ONLY accessory lock. Once the door is ajar, the chain can either be over-



Vertical bolt.

come by brute force, snipped with wire cutters, or removed from its slot by reaching through the door and jiggling the chain loose. Because of the vulnerability of chain locks, peep-holes are better for screening visitors.

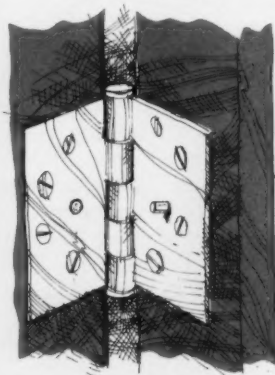
MORE THAN ONE ADEQUATE EXTRA LOCK ADDS LITTLE OR NOTHING TO SECURITY. Too many locking devices can, in fact, create a fire hazard by interfering with your escape during an emergency. This is a major concern when a double cylinder lock is used (a lock that requires a key to unlock from the inside). Be sure the key is accessible to the entire family as a safety precaution.

Hinges

People often overlook the security value of the door hinge. A well-secured hinge protects a home against two types of entry:

- forcing the door out of the frame by applying pressure to the hinged side, and
- removing the hinge pins and lifting the door out of its frame.

Interlocking hinge.



A door opening outward is less vulnerable than one opening inward because it is much more difficult to pull a door out of its frame than to push it in. However, if the door does open outward, the hinge pins are accessible. By removing them, the door can easily be taken out of its frame. Therefore, either the hinge pins should not be removable, or the leaves of the hinges should interlock when the door is closed.

The "Best" Door

It would be difficult to define the "most secure" door because of the many combinations of materials and the varying quality of workmanship in the installation of doors. A wood door of solid-core construction, 4.4 cm ($1\frac{3}{4}$ inches) thick, should offer adequate protection against forced entry. The metal doors often used in apartments are even better. The door should be hung on a well-fitted door frame and secured with a good dead-bolt lock.

The strongest, most secure door is WORTHLESS if left UNLOCKED. MAKE LOCKING YOUR DOOR A HABIT, even if you are "just out for a minute" or "expecting someone."

Checking Security

If you can, have your home checked for security. Many local police departments now have community crime prevention programs and will gladly conduct a security survey of your home, free of charge.

The information in this article resulted from research performed by the Law Enforcement Standards Laboratory, National Bureau of Standards, under the sponsorship of the National Institute for Law Enforcement and Criminal Justice, U.S. Department of Justice. □

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